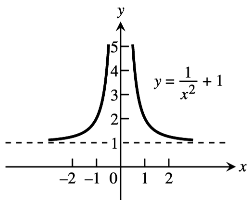
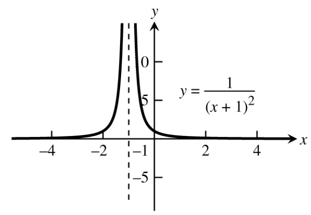
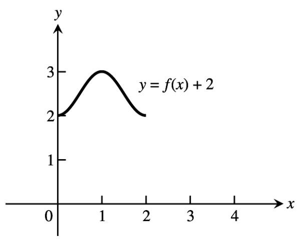
53.



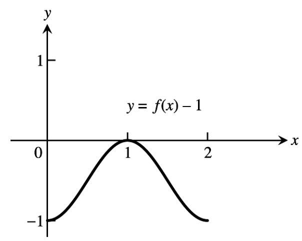
54.



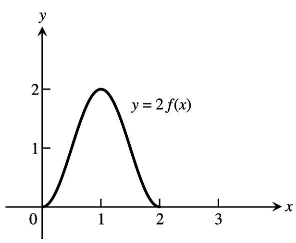
55. (a) domain: $[0, 2]$; range: $[2, 3]$



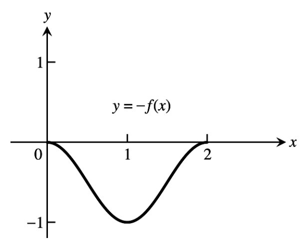
(b) domain: $[0, 2]$; range: $[-1, 0]$



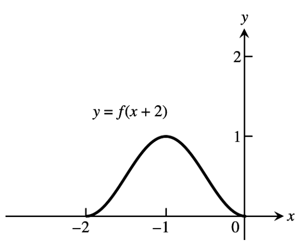
(c) domain: $[0, 2]$; range: $[0, 2]$



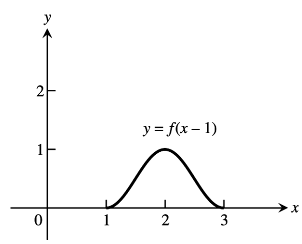
(d) domain: $[0, 2]$; range: $[-1, 0]$



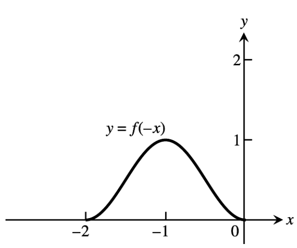
(e) domain: $[-2, 0]$; range: $[0, 1]$



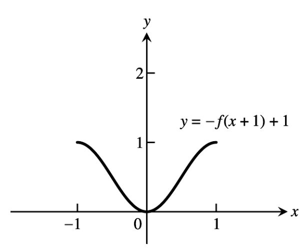
(f) domain: $[1, 3]$; range: $[0, 1]$



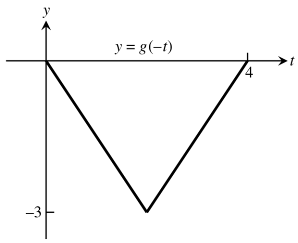
(g) domain: $[-2, 0]$; range: $[0, 1]$



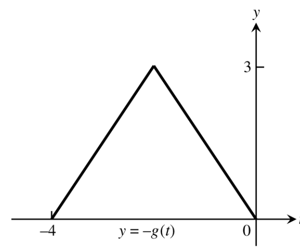
(h) domain: $[-1, 1]$; range: $[0, 1]$



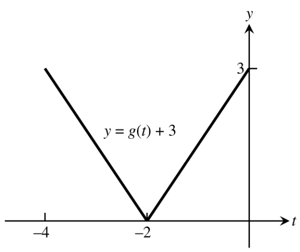
56. (a) domain: $[0, 4]$; range: $[-3, 0]$



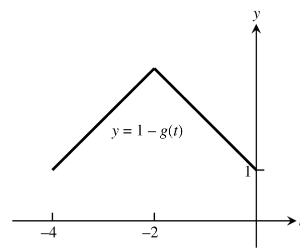
(b) domain: $[-4, 0]$; range: $[0, 3]$



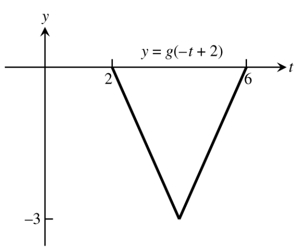
(c) domain: $[-4, 0]$; range: $[0, 3]$



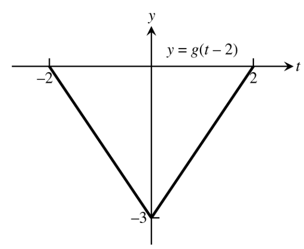
(d) domain: $[-4, 0]$; range: $[1, 4]$



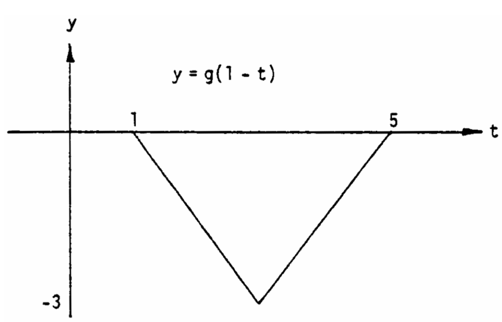
(e) domain: $[2, 4]$; range: $[-3, 0]$



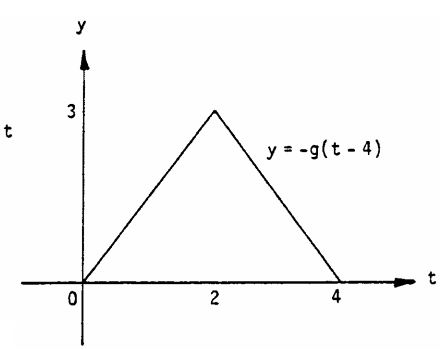
(f) domain: $[-2, 2]$; range: $[-3, 0]$



(g) domain: $[1, 5]$; range: $[-3, 0]$



(h) domain: $[0, 4]$; range: $[0, 3]$



57. $y = 3x^2 - 3$

58. $y = (2x)^2 - 1 = 4x^2 - 1$

59. $y = \frac{1}{2}\left(1 + \frac{1}{x^2}\right) = \frac{1}{2} + \frac{1}{2x^2}$

60. $y = 1 + \frac{1}{(x/3)^2} = 1 + \frac{9}{x^2}$

61. $y = \sqrt{4x + 1}$

62. $y = 3\sqrt{x + 1}$

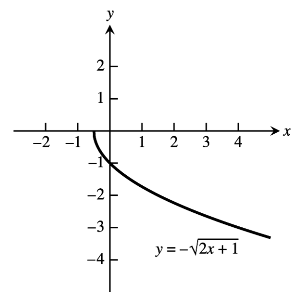
63. $y = \sqrt{4 - \left(\frac{x}{2}\right)^2} = \frac{1}{2}\sqrt{16 - x^2}$

64. $y = \frac{1}{3}\sqrt{4 - x^2}$

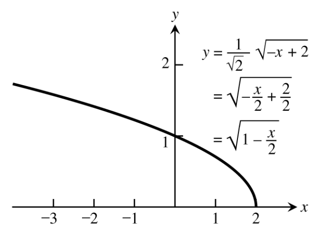
65. $y = 1 - (3x)^3 = 1 - 27x^3$

66. $y = 1 - \left(\frac{x}{2}\right)^3 = 1 - \frac{x^3}{8}$

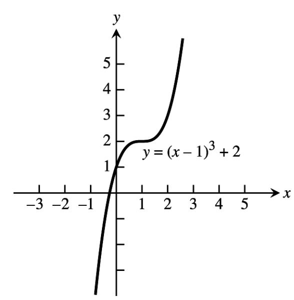
67. Let $y = -\sqrt{2x+1} = f(x)$ and let $g(x) = x^{1/2}$, $h(x) = \left(x + \frac{1}{2}\right)^{1/2}$, $i(x) = \sqrt{2}\left(x + \frac{1}{2}\right)^{1/2}$, and $j(x) = -\left[\sqrt{2}\left(x + \frac{1}{2}\right)^{1/2}\right] = f(x)$. The graph of $h(x)$ is the graph of $g(x)$ shifted left $\frac{1}{2}$ unit; the graph of $i(x)$ is the graph of $h(x)$ stretched vertically by a factor of $\sqrt{2}$; and the graph of $j(x) = f(x)$ is the graph of $i(x)$ reflected across the x-axis.



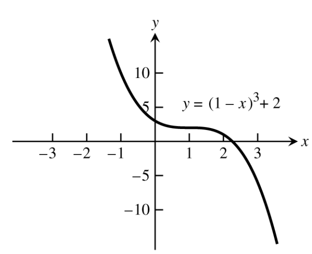
68. Let $y = \sqrt{1 - \frac{x}{2}} = f(x)$. Let $g(x) = (-x)^{1/2}$, $h(x) = (-x+2)^{1/2}$, and $i(x) = \frac{1}{\sqrt{2}}(-x+2)^{1/2}$ $= \sqrt{1 - \frac{x}{2}} = f(x)$. The graph of $g(x)$ is the graph of $y = \sqrt{x}$ reflected across the x-axis. The graph of $h(x)$ is the graph of $g(x)$ shifted right two units. And the graph of $i(x)$ is the graph of $h(x)$ compressed vertically by a factor of $\sqrt{2}$.



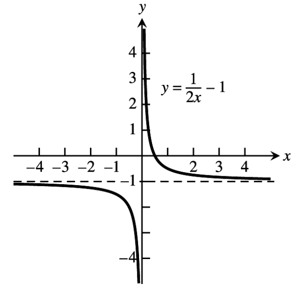
69. $y = f(x) = x^3$. Shift $f(x)$ one unit right followed by a shift two units up to get $g(x) = (x-1)^3 + 2$.



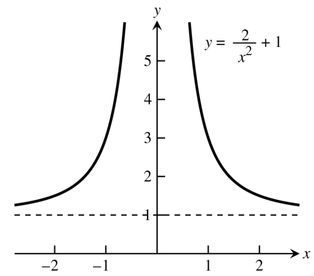
70. $y = (1-x)^3 + 2 = -[(x-1)^3 + (-2)] = f(x)$.
Let $g(x) = x^3$, $h(x) = (x-1)^3$, $i(x) = (x-1)^3 + (-2)$, and $j(x) = -[(x-1)^3 + (-2)]$. The graph of $h(x)$ is the graph of $g(x)$ shifted right one unit; the graph of $i(x)$ is the graph of $h(x)$ shifted down two units; and the graph of $f(x)$ is the graph of $i(x)$ reflected across the x-axis.



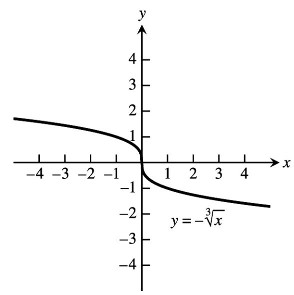
71. Compress the graph of $f(x) = \frac{1}{x}$ horizontally by a factor of 2 to get $g(x) = \frac{1}{2x}$. Then shift $g(x)$ vertically down 1 unit to get $h(x) = \frac{1}{2x} - 1$.



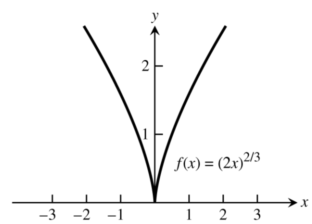
72. Let $f(x) = \frac{1}{x^2}$ and $g(x) = \frac{2}{x^2} + 1 = \frac{1}{\left(\frac{x^2}{2}\right)} + 1$
$= \frac{1}{\left(x/\sqrt{2}\right)^2} + 1 = \frac{1}{\left[\left(1/\sqrt{2}\right)x\right]^2} + 1$. Since
$\sqrt{2} \approx 1.4$, we see that the graph of $f(x)$ stretched horizontally by a factor of 1.4 and shifted up 1 unit is the graph of $g(x)$.



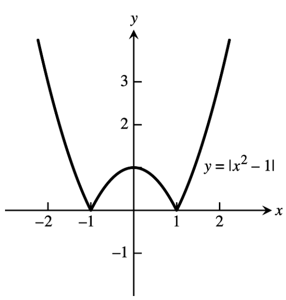
73. Reflect the graph of $y = f(x) = \sqrt[3]{x}$ across the x-axis to get $g(x) = -\sqrt[3]{x}$.



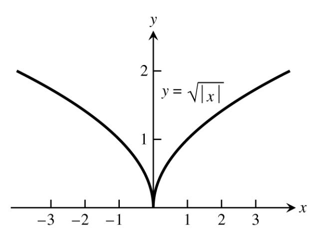
74. $y = f(x) = (-2x)^{2/3} = [(-1)(2)x]^{2/3}$
$= (-1)^{2/3}(2x)^{2/3} = (2x)^{2/3}$. So the graph of $f(x)$ is the graph of $g(x) = x^{2/3}$compressed horizontally by a factor of 2.



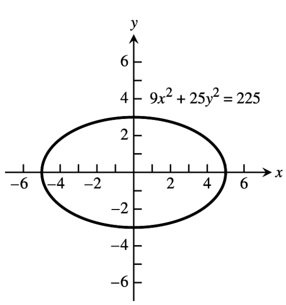
75.



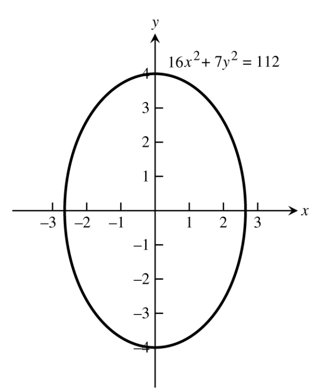
76.



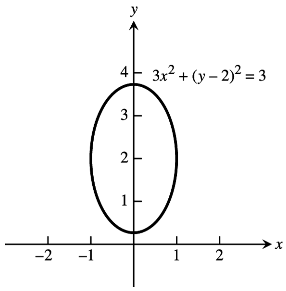
77. $9x^2 + 25y^2 = 225 \Rightarrow \frac{x^2}{5^2} + \frac{y^2}{3^2} = 1$



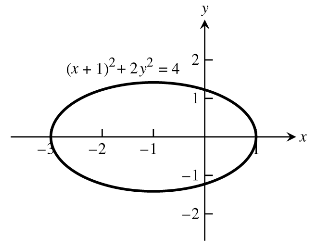
78. $16x^2 + 7y^2 = 112 \Rightarrow \frac{x^2}{\left(\sqrt{7}\right)^2} + \frac{y^2}{4^2} = 1$



79. $3x^2 + (y-2)^2 = 3 \Rightarrow \frac{x^2}{1^2} + \frac{(y-2)^2}{\left(\sqrt{3}\right)^2} = 1$

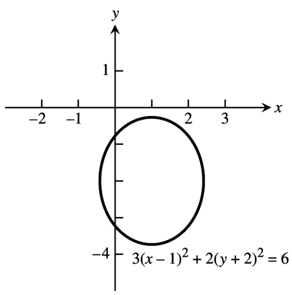


80. $(x+1)^2 + 2y^2 = 4 \Rightarrow \frac{[x-(-1)]^2}{2^2} + \frac{y^2}{\left(\sqrt{2}\right)^2} = 1$



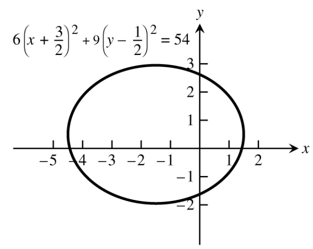
81. $3(x-1)^2 + 2(y+2)^2 = 6$

$\Rightarrow \frac{(x-1)^2}{\left(\sqrt{2}\right)^2} + \frac{[y-(-2)]^2}{\left(\sqrt{3}\right)^2} = 1$

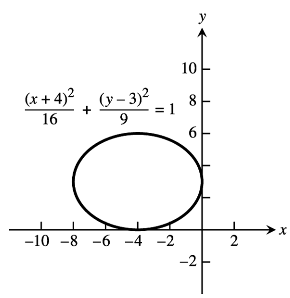


82. $6\left(x+\frac{3}{2}\right)^2 + 9\left(y-\frac{1}{2}\right)^2 = 54$

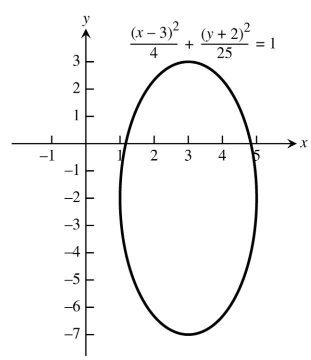
$\Rightarrow \frac{\left[x-\left(-\frac{3}{2}\right)\right]^2}{3^2} + \frac{\left(y-\frac{1}{2}\right)^2}{\left(\sqrt{6}\right)^2} = 1$



83. $\frac{x^2}{16} + \frac{y^2}{9} = 1$ has its center at $(0, 0)$. Shiftinig 4 units left and 3 units up gives the center at $(h, k) = (-4, 3)$. So the equation is $\frac{[x-(-4)]^2}{4^2} + \frac{(y-3)^2}{3^2} = 1$ $\Rightarrow \frac{(x+4)^2}{4^2} + \frac{(y-3)^2}{3^2} = 1$. Center, C, is $(-4, 3)$, and major axis, $\overline{AB}$, is the segment from $(-8, 3)$ to $(0, 3)$.



84. The ellipse $\frac{x^2}{4} + \frac{y^2}{25} = 1$ has center $(h, k) = (0, 0)$. Shifting the ellipse 3 units right and 2 units down produces an ellipse with center at $(h, k) = (3, -2)$ and an equation $\frac{(x-3)^2}{4} + \frac{[y-(-2)]^2}{25} = 1$. Center, C, is $(3, -2)$, and $\overline{AB}$, the segment from $(3, 3)$ to $(3, -7)$ is the major axis.



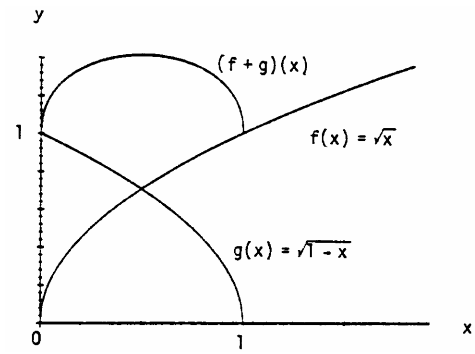
85. (a) $(fg)(-x) = f(-x)g(-x) = f(x)(-g(x)) = -(fg)(x)$, odd

(b) $\left(\frac{f}{g}\right)(-x) = \frac{f(-x)}{g(-x)} = \frac{f(x)}{-g(x)} = -\left(\frac{f}{g}\right)(x)$, odd

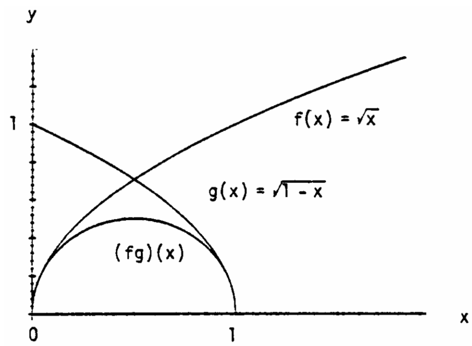
(c) $\left(\frac{g}{f}\right)(-x) = \frac{g(-x)}{f(-x)} = \frac{-g(x)}{f(x)} = -\left(\frac{g}{f}\right)(x)$, odd
(d) $f^2(-x) = f(-x)f(-x) = f(x)f(x) = f^2(x)$, even
(e) $g^2(-x) = (g(-x))^2 = (-g(x))^2 = g^2(x)$, even
(f) $(f \circ g)(-x) = f(g(-x)) = f(-g(x)) = f(g(x)) = (f \circ g)(x)$, even
(g) $(g \circ f)(-x) = g(f(-x)) = g(f(x)) = (g \circ f)(x)$, even
(h) $(f \circ f)(-x) = f(f(-x)) = f(f(x)) = (f \circ f)(x)$, even
(i) $(g \circ g)(-x) = g(g(-x)) = g(-g(x)) = -g(g(x)) = -(g \circ g)(x)$, odd

86. Yes, $f(x) = 0$ is both even and odd since $f(-x) = 0 = f(x)$ and $f(-x) = 0 = -f(x)$.

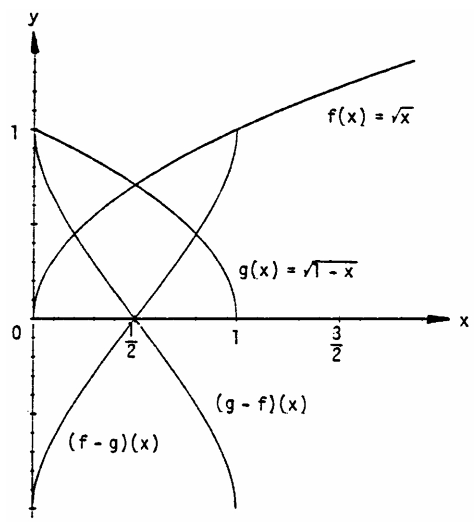
87. (a)



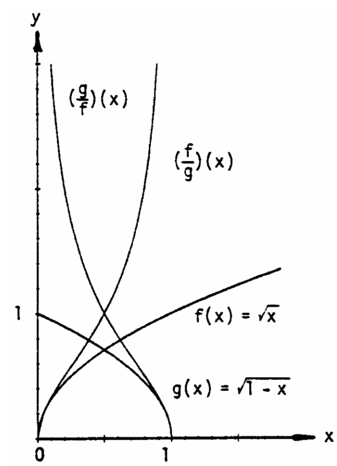
(b)



(c)



(d)



88.